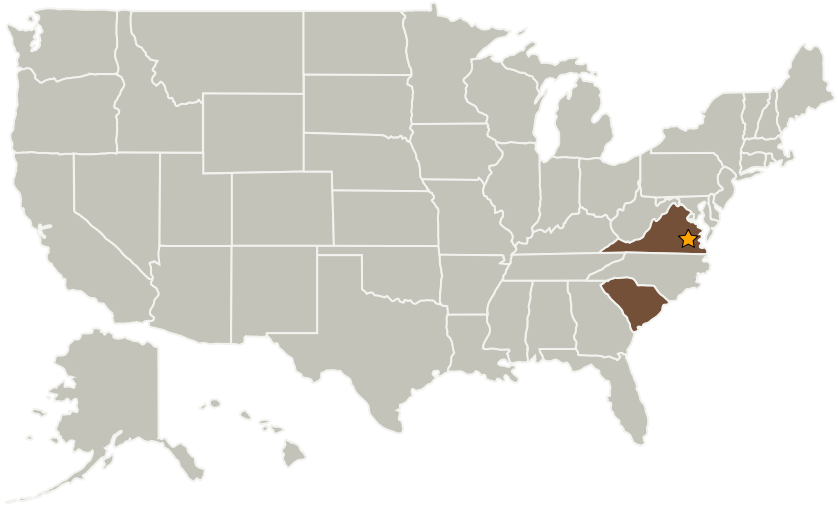
Ultraviolet AlGaN-based Avalanche Photo Diode Grown over Single Crystal Bulk AlN Substrates, Phase I

Completed Technology Project (2004 - 2004)

Project Introduction

Premature breakdown is a key obstacle in developing AlGaN-based avalanche photo diodes (APD) for ultraviolet (UV) light detection. Novel materials growth techniques, such as Hydride Vapor Phase Epitaxy (HVPE) allows for reduction of dislocation density only to approximately 10^7 cm-2. In order to reduce the number of growth defects and dislocation density in AlGaN-based APDs we will use single crystal bulk AlN substrates. We recently demonstrated that the use of a bulk AlN substrate allows us to reduce the dislocation density in the epitaxial AlN layers by more than four orders of magnitude down to 10^4-10^5 cm-2. The reduction of dislocation density below 10^4 cm-2 would enable us to fabricate up to 100 ?m diameter devices in dislocation-free areas of the wafers. Hence, we expect that AlGaN-based APDs on bulk AlN substrates will exhibit major improvements in the breakdown voltages required for stable performance of the devices.

Primary U.S. Work Locations and Key Partners



Organizations Performing Work	Role	Type	Location
★Langley Research Center(LaRC)	Lead Organization	NASA Center	Hampton, Virginia
Sensor Electronic Technology, Inc.	Supporting Organization	Industry	Columbia, South Carolina

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Organizational Responsibility

Responsible Mission Directorate:

Space Technology Mission Directorate (STMD)

Lead Center / Facility:

Langley Research Center (LaRC)

Responsible Program:

Small Business Innovation Research/Small Business Tech Transfer

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South Carolina	Virginia

Project Management

Program Director:

Jason L Kessler

Program Manager:

Carlos Torrez

Principal Investigator:

Yuriy Bilenko

Technology Areas

Primary:

- TX08 Sensors and Instruments
  - TX08.1 Remote Sensing Instruments/Sensors
    - TX08.1.1 Detectors and Focal Planes